REMARKS

This is in response to the Office Action dated April 5, 2004. Accordingly, this response is accompanied by a request for a two-month extension of time, together with the required fee.

In that Action, the drawings were objected to under 37 C.F.R. § 1.83(a), a new title was required, and correction of certain informalities in the specification was required. In addition, claims 1 – 38 and 61 – 93 were withdrawn from consideration as being drawn to a non-elected invention. Claims 39, 40, 42 and 60 were objected as having informalities. Claims 49, 54, 55 and 94 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 39 – 56, 58 – 60 and 94 – 103 were all rejected under 35 U.S.C. §102(b) or 103(a) based on prior art. Claim 57 was objected to as depending from a rejected base claim. All of these issues are addressed hereafter.

The Drawings

As recommended by the Examiner, Figure 10, item 96 has been amended to read: "A/D CONVERTERS". As the text of the specification refers to "A/D converters 96" this does not introduce any new matter. A new drawing accompanies this response.

The Title

The specification has been amended to change the title to: "EQUALIZATION FOR A MULTI-AXIS IMAGING SYSTEM". It is submitted that this title is appropriately descriptive of the subject matter of the elected invention.

The Disclosure

The specification has been amended at page 4, line 31, and page 13, lines 18 and 20, to change "D/A" to -- A/D--. This does not introduce any new matter because it is clear from the text and the drawings that "D/A" was an error. However, Applicant wishes to point out that the reference at page 13, line 15 to "digital-to-analog converters" is correct. The disclosed system may have digital-to-analog converters to convert commands of the processor 80 to analog signals for amplifier gains and A/D converter offsets.

The specification has also been amended at page 5, line 2, to insert --of-- between "plurality" and "light", and at page 15, line 4, to change "amplifiers94" to --amplifiers 94--, and at line 10 to change "on" to --one--. It is clear that these are merely corrections of typographical errors that do not introduce any new matter.

Claim Informalities

Claim 39 has been cancelled and replaced by new claim 104, which obviates the informality objection to claim 39.

Claims 40 and 42 have been amended and, as amended, the reference to "an image" no longer exists. Accordingly, the informality objection to claims 40 and 42 is also obviated.

Claims 60 and 96 have been amended to insert --by-- between "values" and "a", thereby obviating the informality objections to those claims.

Indefiniteness Rejections

In claims 49 and 55, "equalizing" has been changed to --equalizer--. In claim 54, "an array of individual light-emitting sources" has been changed to --a plurality of individual light sources--. Claim 94 has been cancelled and replaced by new claim 105. It is submitted that these amendments overcome the rejections of the aforementioned claims for indefiniteness under 35 U.S.C. § 112.

Objection to Claim 57

Claim 57 has been cancelled and rewritten in independent form as new claim 106, including all of the limitations of the base claim and the intervening claims.

Rejections Based on Prior Art

Applicants' equalization system and equalizing method are adapted for use in a multi-axis imaging system having an array of imaging elements and corresponding light detectors. In a preferred application, the imaging elements are individual miniature microscopes, the detectors are linear arrays of point detector elements, and the array is

used to scan a biological specimen so that a composite image of the entire specimen can be created from the data collected during the scan.

In such a scanning array microscope either trans-illumination or epi-illumination may be used. The illumination light may be provided either by a single source or multiple sources corresponding to the imaging elements of the multi-axis imaging system. In any case, even for a specimen of uniform transmissivity or reflectivity, the optical power reaching each imaging element typically varies because of physical limits on the illumination optics and, even if uniform power is delivered to all of the imaging elements, the electrical outputs from the detectors typically will vary due to physical limits on the production of detector arrays with identical responsivities. Moreover, the individual detector arrays typically also produce varying DC offsets for the same reason.

Yet, to create a composite image of an entire specimen from the data provided by a plurality of imaging elements and corresponding detectors, the data from all of the elements must exhibit the same background value and dynamic range. Thus, it turns out that equalization among all of the independent elements of the multi-axis imaging system is needed.

To clarify the distinctions between Applicants' invention and the prior art, claims 39 and 94 have been cancelled and replaced by new claims 104 and 105, respectively. New claims 104 and 105 make clear that Applicants' invention is adapted for use with a multi-axis imaging system and that it equalizes detector output values among a plurality of imaging elements of the multi-axis imaging system for given amounts of optical power illuminating the respective fields of view of the imaging elements.

In addition, various amendments have been made to claims 40 – 60 and 95 – 103 to change dependencies where necessary and to make terminology consistent with claims 104 and 105, respectively. New method claims 106 through 111, dependent from base claim 105, have been added.

None of the references of record is directed to a multi-axis imaging system nor addresses the problem of achieving the same background value and dynamic range for data produced by a plurality of independent imaging elements.

Walsh et al., U.S. Patent No. 5,443,164 ("Walsh") describes the use of several independent single-axis, line-scanning color cameras in a plastic container sorting system. The cameras capture respective transmittance and reflectance images of containers that pass by them. The data from each individual camera are equalized with respect to a calibration value to compensate for the sensitivity differences associated with the CCD elements in the camera. Walsh does not disclose a multi-axis imaging system; the data from the individual cameras provide complete, independent images. Walsh exhibits no recognition of the problem of achieving the same background and dynamic range for data produced by a plurality of independent imaging elements of a multi-axis imaging system where the data must be combined to produce a composite image.

Suzuki, U.S. Patent No. 5,801,763 ("Suzuki") describes a single-axis, two-dimensional camera system that incorporates an automatic gain control that controls the average image detector output value for each image. Similarly, Li, U.S. Patent No. 6,577,775 ("Li") describes a scheme for equalizing the single-image data acquired from a single-axis imaging system. These patents do not even recognize the problem of equalizing background and dynamic range for data produced by a plurality of independent imaging elements in a multi-axis imaging system.

Yoshida et al., U.S. Patent No. 5,051,574 ("Yoshida") does not describe an imaging system at all. What it appears to describe is merely a circuit in which the drive currents to respective sources of a plurality of source and detector pairs in a light blocking detection system are adjusted to ensure that the pairs are equalized.

Although Bamberger et al., U.S. Patent No. 5,970,164 ("Bamberger") discusses improving image contrast by logarithmic equalization, it does not teach or suggest the use of such equalization in a multi-axis imaging system.

Thus, all of Walsh, Suzuki, Li, Yoshida, and Bamberger fail to address the problem of equalizing the background and dynamic range of data from multiple images of an array of independent imaging elements in a multi-axis imaging system, particularly where the illumination power may not be uniformly distributed among those elements. Moreover, Applicants' invention is likely to defeat the equalization goals of the references. While the references seek to optimize the outputs of a single imaging element, or blocking detection system, Applicants' invention seeks to optimize the

outputs of an array of multiple independent imaging elements as a whole. The set of equalization coefficients for individual elements of the array for optimum array performance ordinarily will be different from those coefficients that would optimize performance of any one of the individual imaging elements. As a result, some, if not all of the individual elements, will experience suboptimal performance, which would defeat the goal of a single-axis system.

Applicants therefore submit that all of the claims remaining in the case after the amendments made herein patentably distinguish over the prior art of record. Accordingly, Applicants request that the Examiner enter the amendments, reconsider the rejections, allow the claims remaining in this case that have not been withdrawn from consideration, and pass this case to issue.

Respectfully submitted,

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